CLAIMS

We claim the following:

1. A carbon nanotube-polymer composite actuator comprising:

   at least one electrolyte;

   at least two electric conducting electrodes separated by said at least one electrolyte; and

   at least one electrode providing an electromechanical response upon application of an electronic voltage between said at least two electric conducting electrodes.

2. The carbon nanotube-polymer composite actuator of claim 1, wherein at least one of the electrodes comprises a carbon nanotube-polymer composite.

3. The carbon nanotube-polymer composite actuator of claim 2, wherein the carbon nanotube-polymer is between 0.1-18 weight percent single wall carbon nanotubes.

4. The carbon nanotube-polymer composite actuator of claim 2, wherein the carbon-nanotube composite is prepared by polymer processing material techniques.

5. The carbon nanotube-polymer composite actuator of claim 2, wherein the carbon-nanotube composite is prepared by the following method

   preparing a carbon nanotube-polymer solution;

   casting the carbon nanotube-polymer solution, forming a carbon nanotube-polymer composite;

   drying the carbon nanotube-polymer composite;

   doping the carbon nanotube-polymer composite with a metal;

6. The carbon nano-tube polymer composite actuator of claim 5, wherein the nano-tube polymer solution is prepared by mixing: a polymer, carbon nanotubes and a liquid, wherein the polymer is soluble or dispersible in the liquid.
7. The carbon nanotube-polymer composite actuator of claim 6, wherein the carbon nano-tubes are single wall carbon nanotubes.
8. The carbon nanotube-polymer composite actuator of claim 6, wherein the polymer is selected from the group consisting of: ionomers, smart gels, polyelectrolytes, ionic polymers, ionically doped polymers, and combinations thereof.
9. The carbon nanotube-polymer composite actuator of claim 6, wherein the polymer is a perfluorinated ionomeric polymer.
10. The carbon nanotube-polymer composite actuator of claim 6, wherein the liquid is an alcohol.
11. The carbon nanotube-polymer composite actuator of claim 5, further comprising: high shear stirring the carbon nanotube-polymer solution before casting.
12. The carbon nanotube-polymer composite actuator of claim 5, further comprising: homogenizing the carbon nanotube-polymer solution before casting.
13. The carbon nanotube-polymer composite actuator of claim 5, further comprising: centrifuging the carbon nano-tube polymer solution before casting.
14. The carbon nano-tube polymer composite actuator of claim 5, wherein the metal is selected from the group consisting of: platinum, gold, copper and combinations thereof.
15. The carbon nanotube-polymer composite actuator of claim 1, wherein the electrolyte is selected from the group consisting of: monovalent metal ions, polyvalent metal ions and combinations thereof.

16. The carbon nanotube-polymer composite actuator of claim 5, wherein the carbon nanotube is a multi wall nanotube, a nanohorn or other fibrous carbon nanostructerd material.

17. The carbon nanotube-polymer composite actuator of claim 5, wherein the composite is produced by a technique selected from the group consisting of: melt polymerization, extrusion, and solution casting.

18. The carbon nanotube-polymer composite actuator of claim 5, wherein the actuator is capable of operating in aqueous, non-aqueous, gel, or solution free environments.

19. The carbon nanotube-polymer composite actuator of claim 5, wherein the electro-chemical response includes an osmotic mechanism.

20. The carbon nanotube-polymer composite actuator of claim 5, further comprising a surfactant applied to the actuator.

21. The carbon nanotube-polymer composite actuator of claim 5, wherein at least one electrode is a ceramic

22. The carbon nanotube-polymer composite actuator of claim 1 where at least one of the electrodes is comprised of nanostructured materials.